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National Eutrophication Survey, Las Vegas, Nev

Prepared for

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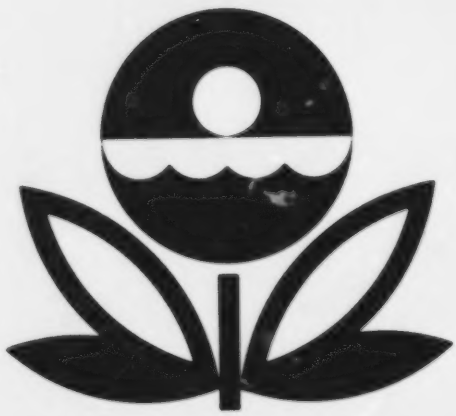
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
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REPORT
ON
UPPER PAHRANAGAT LAKE
LINCOLN COUNTY
NEVADA

EPA REGION IX

WORKING PAPER No. 812

WITH THE COOPERATION OF THE

NEVADA ENVIRONMENTAL PROTECTION SERVICE

AND THE

NEVADA NATIONAL GUARD

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

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REPORT ON UPPER PAHRANAGAT LAKE

LINCOLN COUNTY, NEVADA

EPA REGION IX

by

National Eutrophication Survey

Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Special Studies Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 812

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U.S. ENVIRONMENTAL PROTECTION AGENCY

September 1977

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the States.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Nevada State Environmental Protection Service for professional involvement, to the Nevada National Guard for conducting the tributary sampling phase of the Survey, and to those Nevada wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Department of Conservation and Natural Resources, Division of Environmental Protection, State Environmental Protection Service provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

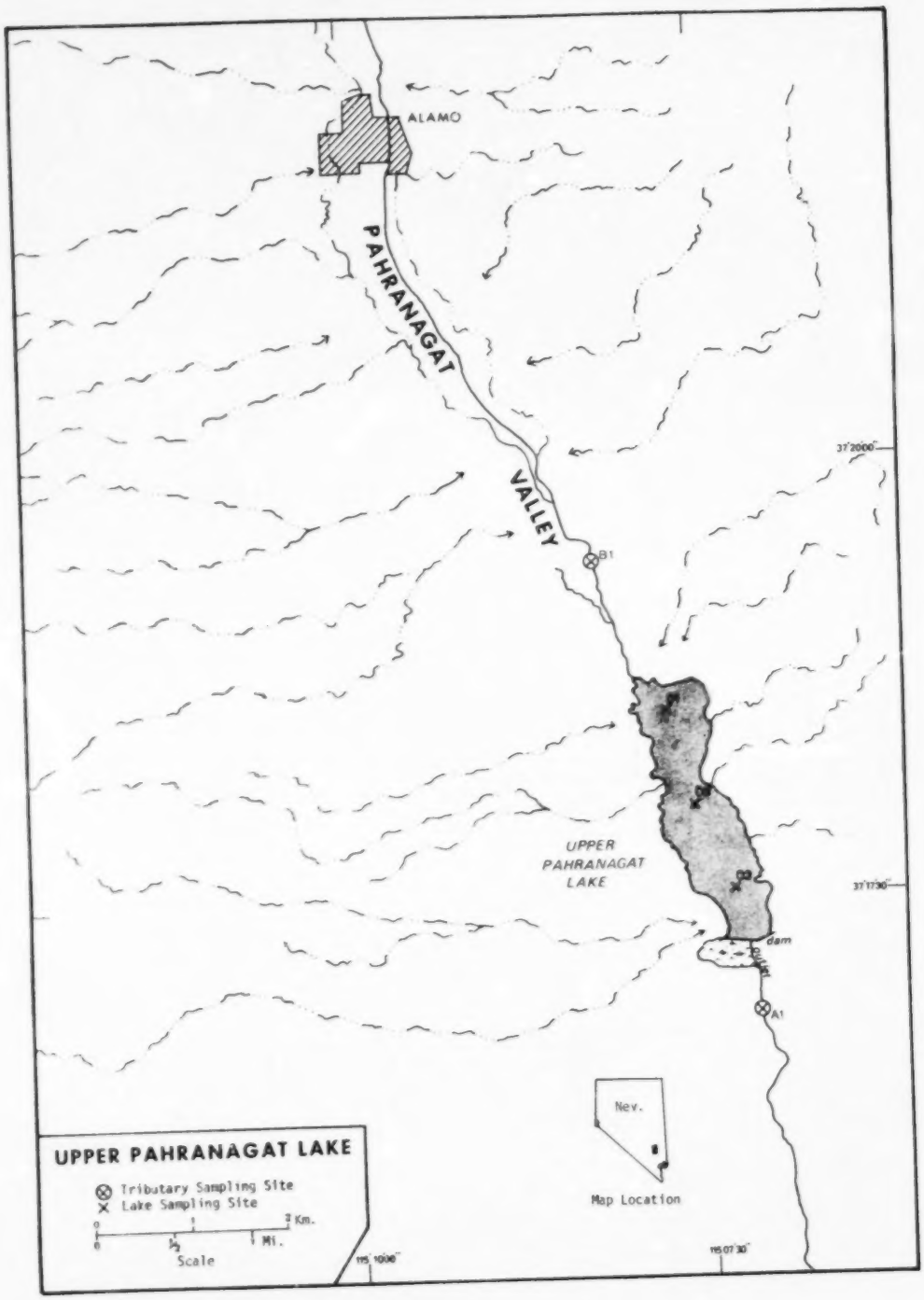
Major General Floyd L. Edsall, the Adjutant General of Nevada, and Project Officer Major Harold E. Roberts, who directed the volunteer efforts of the Nevada National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

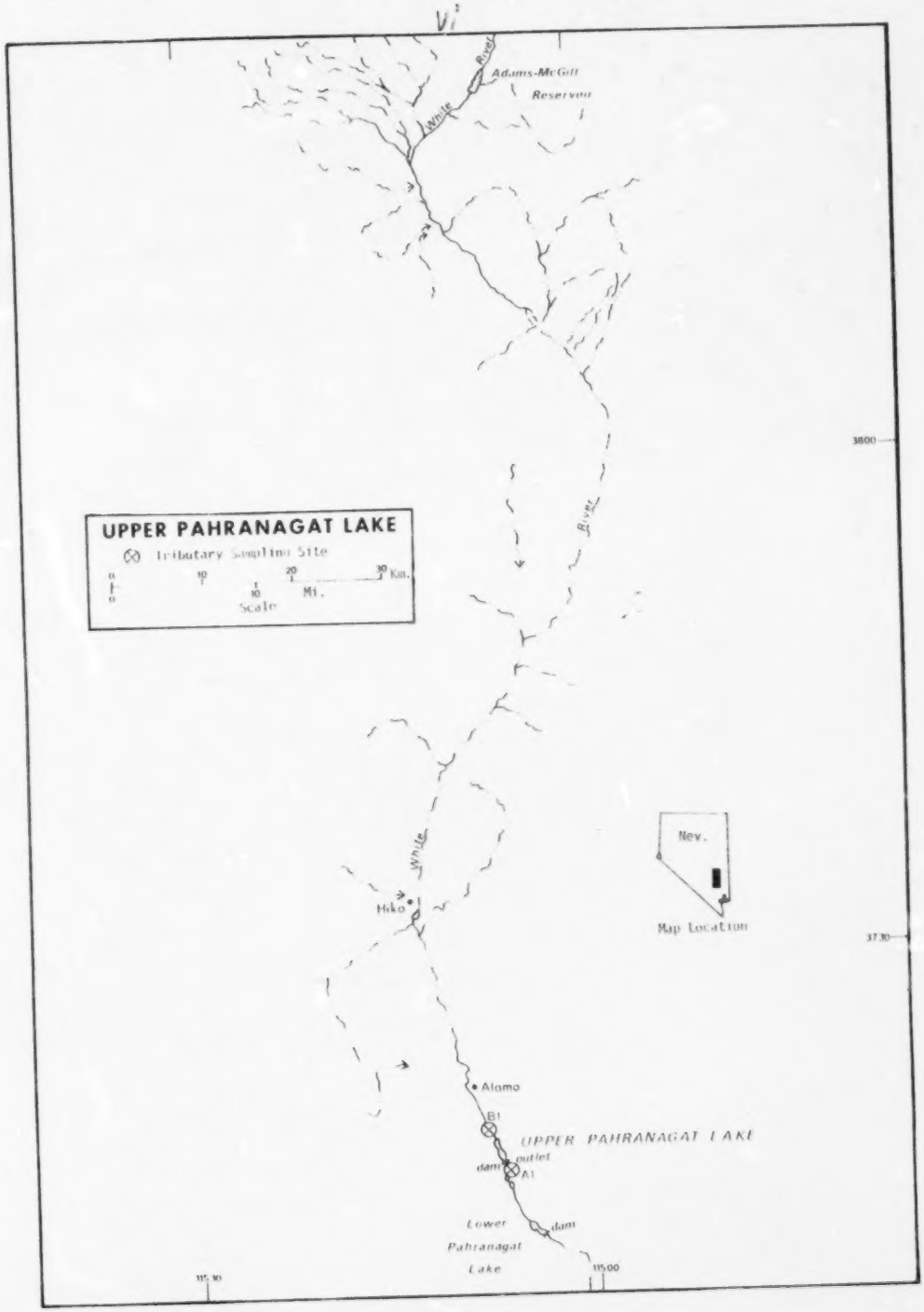
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEVADA

LAKE NAME	COUNTY
Lake Mead	Clark (Mohave in Arizona)
Lahontan Reservoir	Lyon, Churchill
Rye Patch Reservoir	Pershing
Lake Tahoe	Washoe, Carson City, Douglas (Placer, El Dorado in CA)
Topaz Reservoir	Douglas (Mono in CA)
Upper Pahranagat Lake	Lincoln
Washoe Lake	Washoe
Wildhorse Reservoir	Elko
Wilson Reservoir	Elko
Walker Lake	Mineral


ALAMO
PAHRANAGAT
VALLEY
B1
37°20'00"
UPPER
PAHRANAGAT
LAKE
37°17'30"
dam
A1
Nev.
Map Location
UPPER PAHRANAGAT LAKE
Tributary Sampling Site
Lake Sampling Site
0 1 2 Km.
0 ½ 1 Mi.
Scale
115°10'00"
115°07'30"


Adams-McGill
Reservoir
White River
UPPER PAHRANAGAT LAKE
Tributary Sampling Site
0 10 20 30 Km.
0 10 Mi.
Scale
White River
Nev.
Map Location
Hiko
Alamo
B1
UPPER PAHRANAGAT LAKE
outlet
dam
A1
Lower
Pahranagat
Lake
dam
3800
37 30
115 30
115 00

REPORT ON UPPER PAHRANAGAT LAKE, NEVADA

STORET NO. 3207

I. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Upper Pahranagat Lake is eutrophic, i.e., nutrient rich and highly productive. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual or potential impact upon designated beneficial water uses of the lake.

Potential for primary production as measured by the algal assay control yield was low. Secchi disc visibility was quite low. Of the 10 Nevada lakes sampled in 1975, 3 had higher median total phosphorus values (0.173 mg/l), 5 had higher median inorganic nitrogen levels (0.125 mg/l), and 6 had higher median orthophosphorus values (0.026 mg/l) than Upper Pahranagat Lake.

Survey limnologists reported emergent vegetation accumulation along half of the shoreline on their visits to the lake.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Upper Pahranagat Lake was limited by available phosphorus during the sample collection time (05/06/75). Lake data suggest primary limitation by nitrogen on the three sampling occasions.

*See Appendix E.

C. Nutrient Controllability:

1. Point sources -

There were no known point sources impacting Upper Pahranagat Lake during the sampling year.

The present phosphorus loading of 1.30 g $P/m^2/yr$ is over three times that proposed by Vollenweider (1975) as "eutrophic" for a lake of such volume and hydraulic retention time. The Nevada Environmental Protection Services (1976) reports that the primary problem of the lake, that of high phosphorus levels, is mainly attributable to agricultural runoff and natural non-point contributions.

2. Nonpoint sources -

The White River (B-1) contributed 53.8% of the total phosphorus load to Upper Pahranagat Lake during the sampling year; ungaged tributaries and immediate drainage contributed an estimated 15.0%.

Upper Pahranagat Lake is in the Pahranagat National Wildlife Refuge. Considerable numbers of ducks and geese utilize the reservoir. On the basis of numbers provided by the U.S. Fish and Game Department and certain assumptions (see page 10), it is estimated that wildfowl contributed 380 kg of phosphorus (30.0% of the total load) to the lake during the sampling year.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake morphometry data were provided by James B. Williams, Jr. (personal communication). Tributary flow data were provided by the Nevada District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. The difference between inflow and outflow to the lake can be attributed to high evaporation in the area in irrigational water uses. Mean hydraulic retention time was obtained by dividing the lake volume by the mean flow of the outlet. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 0.97 km^2.
2. Mean depth: 0.6 meters.
3. Maximum depth: 1.5 meters.
4. Volume: 0.592 x 10^6 m^3.
5. Mean hydraulic retention time: 57 days.

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

Name	Drainage area (km^2)	Mean Flow (m^3/sec)
B-1 White River	6,765.1	0.22
Minor tributaries and immediate drainage -	78.3	0.04
Total	6,843.4	0.26
2. Outlet - A-1 White River	6,845.4	0.12

C. Precipitation:

1. Year of sampling: 21.2 cm.
2. Mean annual: 22.1 cm.

III. LAKE WATER QUALITY SUMMARY

Upper Pahranagat Lake was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations (Station 01 was sampled only once) on the lake and from one or more depths at each station (see maps, pages v,vi). During each visit, depth-integrated samples were collected from each station for phytoplankton identification and enumeration. During the first visit, an 18.9-liter depth-integrated sample was composited for algal assays. Maximum depths sampled were 1.5 meters at Station 01, 2.1 meters at Station 02, and 2.7 meters at Station 03. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

STORET CODE 3237

PARAMETER	N*	(7/ 6/75) S*** = 3 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(8/21/75) S*** = 2 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(11/21/75) S*** = 2 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	12.5- 13.5	13.5	0.0- 1.5	3	18.0- 20.0	20.0	0.0- 0.9	2	9.0- 9.0	9.0	0.0- 0.0
MAX DEPTH**	3	11.5- 13.5	12.5	1.5- 2.7	2	18.0- 20.0	19.0	0.0- 0.9	2	9.0- 9.0	9.0	0.0- 0.0
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	5	7.8- 8.4	8.2	0.0- 1.5	3	6.4- 7.4	7.2	0.0- 0.9	2	10.8- 11.4	11.1	0.0- 0.0
MAX DEPTH**	2	7.5- 8.6	8.1	2.1- 2.7	2	6.4- 7.4	6.9	0.0- 0.9	2	10.8- 11.4	11.1	0.0- 0.0
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	760.- 840.	775.	0.0- 1.5	0	*****-*****	*****	*****-*****	2	922.- 979.	950.	0.0- 0.0
MAX DEPTH**	3	750.- 800.	760.	1.5- 2.7	0	*****-*****	*****	*****-*****	2	922.- 979.	950.	0.0- 0.0
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	1	6.3- 6.3	6.3	0.0- 0.0	3	8.6- 8.7	8.7	0.0- 0.9	2	8.3- 8.5	8.4	0.0- 0.0
MAX DEPTH**	0	*****-*****	*****	*****-*****	2	8.7- 8.7	8.7	0.0- 0.9	2	8.3- 8.5	8.4	0.0- 0.0
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	5	605.- 680.	620.	0.0- 1.5	3	550.- 605.	595.	0.0- 0.9	2	390.- 400.	395.	0.0- 0.0
MAX DEPTH**	2	580.- 660.	620.	2.1- 2.7	2	550.- 605.	578.	0.0- 0.9	2	390.- 400.	395.	0.0- 0.0
TOTAL P (MG/L)												
0.-1.5 M DEPTH	5	0.029-0.226	0.031	0.0- 1.5	3	0.162-0.309	0.275	0.0- 0.9	2	0.184-0.268	0.226	0.0- 0.0
MAX DEPTH**	2	0.030-0.453	0.241	2.1- 2.7	2	0.275-0.309	0.292	0.0- 0.9	2	0.184-0.268	0.226	0.0- 0.0
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	5	0.012-0.208	0.021	0.0- 1.5	3	0.030-0.044	0.036	0.0- 0.9	2	0.017-0.019	0.018	0.0- 0.0
MAX DEPTH**	2	0.008-0.417	0.212	2.1- 2.7	2	0.036-0.044	0.040	0.0- 0.9	2	0.017-0.019	0.018	0.0- 0.0
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	5	0.060-0.100	0.070	0.0- 1.5	3	0.020-0.020	0.020	0.0- 0.9	2	0.020-0.030	0.025	0.0- 0.0
MAX DEPTH**	2	0.070-0.090	0.080	2.1- 2.7	2	0.020-0.020	0.020	0.0- 0.9	2	0.020-0.030	0.025	0.0- 0.0
AMMONIA (MG/L)												
0.-1.5 M DEPTH	5	0.050-0.070	0.070	0.0- 1.5	3	0.020-0.050	0.030	0.0- 0.9	2	0.030-0.040	0.035	0.0- 0.0
MAX DEPTH**	2	0.060-0.140	0.100	2.1- 2.7	2	0.020-0.050	0.035	0.0- 0.9	2	0.030-0.040	0.035	0.0- 0.0
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	5	0.700-0.900	0.700	0.0- 1.5	3	1.200-2.200	1.300	0.0- 0.9	2	0.500-1.200	0.850	0.0- 0.0
MAX DEPTH**	2	0.700-0.700	0.700	2.1- 2.7	2	1.200-2.200	1.700	0.0- 0.9	2	0.500-1.200	0.850	0.0- 0.0
SECCHI DISC (METERS)	3	0.9- 1.5	1.2		2	0.1- 0.1	0.1		0	*****-*****	*****	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

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B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera		Algal Units Per ml
05/06/75	1.	Chroomonas?	425
	2.	Schroederia	196
	3.	Cryptomonas	163
	4.	Ankistrodesmus	65
	5.	Quadrigula	65
		Other genera	34
		Total	948
08/21/75	1.	Merismopedia	37,834
	2.	Euglena	946
	3.	Cyclotella	883
	4.	Pennate diatom	568
	5.	Phacus	252
		Other genera	1,324
		Total	41,807
11/21/75	1.	Pennate diatom	899
	2.	Navicula	623
	3.	Chroomonas?	254
	4.	Cylindrotheca	231
	5.	Nitzschia	231
		Other genera	436
		Total	2,674

2. Chlorophyll a - Not available for this lake.

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked - 05/06/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.007	0.215	0.2
0.05 P	0.057	0.215	8.8
0.05 P + 1.0 N	0.057	1.215	18.3
1.00 N	0.007	1.215	0.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum*, indicates that the potential for primary productivity in Upper Pahranagat Lake was low during the sample collection time (05/06/75). The increased growth of the test alga over the control yield in response to the addition of phosphorus as well as the lack of response to the addition of nitrogen alone indicates phosphorus limitation. Maximum yield was achieved with the simultaneous addition of both phosphorus and nitrogen.

The mean inorganic nitrogen to orthophosphorus ratios (N/P) in the lake data were 3/1 or less on the three sampling dates suggesting primary limitation by nitrogen (a mean N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

*For further information regarding the algal assay test procedure and selection of test organisms, see U.S. EPA (1971).

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Nevada National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the maps (pages v,vi), except for the high runoff month of July when two samples were collected. Sampling was begun in November 1974, and was completed in October 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Nevada District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual concentrations in the White River at Station B-1 and mean annual ZZ flow.

Estimates of nutrient contributions by wild ducks and geese were based upon information on the number of waterfowl in the Pahranagat National Wildlife Refuge provided by the U.S. Fish and Wildlife Service (Himmel, 1976). The following number of wild ducks and geese assumed to be using Upper Pahranagat Lake are based on one-half of

the refugee total:

	Number	Residence Time (months)
Summer resident ducks	700	5
Summer resident geese	22	8
Migratory ducks	2,700	7
Migratory geese	85	4

In calculating the nutrient loads the following assumptions were made:

1. Each wild duck contributes 0.45 kg total nitrogen and 0.20 kg phosphorus per year (Paloumpis and Starrett 1960).

2. Each wild goose contributes the same amount as one duck since geese typically feed in fields away from the lake several hours each day.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
B-1 White River	680	53.8
b. Minor tributaries and immediate drainage (nonpoint load) -	190	15.0
c. Known municipal STP's - None		
d. Septic tanks - None known		
e. Known industrial - None		
f. Wild ducks and geese -	380	30.0
g. Direct precipitation* -	15	1.2
Total	1,265	100.0%

2. Outputs - A-1 White River 360

3. Net annual P accumulation - 905

*Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
B-1 White River	7,620	67.5
b. Minor tributaries and immediate drainage (nonpoint load) -	1,770	15.7
c. Known municipal STP's - None		
d. Septic tanks - None known		
e. Known industrial - None		
f. Wild ducks and geese -	860	7.6
g. Direct precipitation* -	1,045	9.2
Total	11,295	100.0%

2. Outputs - A-1 White River 5,525

3. Net annual N accumulation - 5,770

*Estimated (See NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
White River	<1	1

E. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between "eutrophic" and "oligotrophic".

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading (g/m^2/yr)
Estimated loading for Upper Pahranagat Lake	1.30
Vollenweider's "eutrophic" loading	0.38
Vollenweider's "oligotrophic" loading	0.19

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEVADA 1/21/77

LAKE CODE 3207 UPPER PAMRANAGAT LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 6845.4

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3207A1	6845.4	0.028	0.017	0.017	0.227	0.283	0.340	0.227	0.113	0.085	0.085	0.028	0.028	0.124
3207H1	6765.1	0.340	0.396	0.538	0.481	0.096	0.068	0.076	0.184	0.062	0.062	0.108	0.232	0.219
3207Z7	79.3	0.085	0.085	0.079	0.241	0.008	0.0	0.0	0.0	0.0	0.0	0.0	0.040	0.044

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 6845.4
SUM OF SUB-DRAINAGE AREAS = 6844.3
TOTAL FLOW IN = 3.18
TOTAL FLOW OUT = 1.48

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3207A1	11	74	0.071	20	0.079				
	12	74	0.008	23	0.008				
	1	75	0.008	22	0.011				
	2	75	0.008	7	0.006				
	3	75	0.113	12	0.113				
	4	75	0.142	21	0.113				
	5	75	0.156	15	0.170				
	6	75	0.113						
	7	75	0.057	7	0.057	18	0.042		
	8	75	0.042	13	0.057				
	9	75	0.071	17	0.071				
	10	75	0.003	21	0.0				
3207H1	11	74	0.368	20	0.396				
	12	74	0.453	23	0.481				
	1	75	0.510	22	0.566				
	2	75	0.481	7	0.481				
	3	75	0.396	12	0.453				
	4	75	0.113	21	0.085				
	5	75	0.037	15	0.028				
	6	75	0.042						
	7	75	0.008	7	0.008	18	0.008		
	8	75	0.003	13	0.003				
	9	75	0.014	17	0.014				
	10	75	0.008	21	0.008				

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 77/01/26
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

320701
37 18 33.0 115 07 48.0 3
UPPER PAHRANAGAT LAKE
32017 NEVADA
110191

/TYPA/AMBNT/LAKE

11EPALES 04001002
0005 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/06	15 10	0000	13.8	8.2	60	840	6.30	615	0.050	0.700	0.100	0.012
	15 10	0005	13.5			800						

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/05/06	15 10	0000	0.029		

STORET RETRIEVAL DATE 77/01/26
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

320702
37 18 02.0 115 07 35.0 3
UPPER PAHRANAGAT LAKE
32017 NEVADA
110191

/TYPA/AMBNT/LAKE

11EPALES 04001002
0008 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/06	15 40	0000	13.5	7.8	47	770		680	0.070	0.900	0.060	0.208
	15 40	0003	12.5	7.8		760		645	0.060	0.700	0.060	0.013
	15 40	0007	11.5	7.6		750		660	0.060	0.700	0.070	0.008
75/08/21	16 30	0000	20.0	7.4	2		8.70	550	0.050	2.200	0.020K	0.044
75/11/21	12 00	0000	9.0	11.4		979	8.50	400	0.030	0.500	0.030	0.017

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/05/06	15 40	0000	0.226		
	15 40	0003	0.031		
	15 40	0007	0.030		
75/08/21	16 30	0000	0.309		
75/11/21	12 00	0000	0.268		

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 77/01/26
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

320703
37 17 33.0 115 07 20.0 3
UPPER PAHRANAGAT LAKE
32017 NEVADA
110191

/TYPA/AMBNT/LAKE

11EPALES 04001002
0010 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/05/06	16	25 0000	13.8	8.2	36	780		605	0.070	0.700	0.070	0.021
	16	25 0005	12.7	8.4		760		620	0.070	0.700	0.080	0.030
	16	25 0009	12.5	8.6		760		580	0.140	0.700	0.090	0.417
75/08/21	16	53 0000	20.0	7.2	5		8.65	595	0.030	1.300	0.020K	0.030
	16	53 0003	18.0	6.4			8.70	605	0.020	1.200	0.020K	0.036
75/11/21	10	30 0000	9.0	10.8		922	8.30	390	0.040	1.200	0.020	0.019

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/05/06	16	25 0000	0.030		
	16	25 0005	0.037		
	16	25 0009	0.453		
75/08/21	16	53 0000	0.162		
	16	53 0003	0.275		
75/11/21	10	30 0000	0.184		

K VALUE KNOWN TO BE LESS
THAN INDICATED

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

...ATE CONTAMINATION SURVEY
...AS, 1974 YEARS

...ATER-QUALITY STATION

320721
37 37 30.0 113 07 15.0 4
White River
32 7.5 ALAMO SE
OZUPPER PARIAWAGAT LAKE 110141
RMDG ON DRT RD 6.2 MI SE OF ALAMO
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE TIME OF SAMPLE	DEPTH OF SAMPLE FEET	00630 NO2+NO3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/11/20 09 20		0.040	0.400	0.045	0.010	0.070
74/12/23 09 00		0.041	1.300	0.025	0.010	0.040
75/01/22 10 15		0.024	1.300	0.032	0.005	0.040
75/02/07 09 20		0.010	1.400	0.230	0.020	0.130
75/03/12 10 00		0.005	0.600	0.025	0.015	0.070
75/04/21 09 00		0.010	1.200	0.020	0.010	0.030
75/05/15 15 30		0.040	0.850	0.075	0.025	0.080
75/07/07 15 20		0.030	0.900	0.030	0.025	0.030
75/07/18 14 15		0.075	1.450	0.040	0.015	0.070
75/08/13 10 10		0.005	2.100	0.030	0.030	0.180
75/09/17 10 00		0.150	1.600	0.085	0.185	0.360
75/10/21 11 00		0.005	1.400	0.015	0.020	0.040

K VALUE KNOWN TO BE LESS THAN INDICATED

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37 14 22.0 113 04 15.0 3

White River

37 7.5 ALAMO SE

T/UPPER MARANAGAT LAKE 110141

RROG ON DRT RD 3.5 MI SE OF ALAMO

11ERALES 04001004

0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	NITROGEN, TOTAL MG/L	NITRO, TOT & DET MG/L	NITRO, AMMONIA TOTAL MG/L	PHOS-ORTHO, DISS (0671) MG/L P	PHOS-TOT (0665) MG/L P
74/11/20	09 45		0.015	0.700	0.030	0.060	0.080
74/12/23	08 15		0.040	0.860	0.015	0.015	0.050
75/01/22	10 50		0.020	1.000	0.040	0.015	0.070
75/02/07	10 30		0.055	1.250	0.045	0.025	0.120
75/03/12	10 15		0.005	0.800	0.020	0.015	0.110
75/04/21	09 15		0.060	1.350	0.060	0.065	0.120
75/05/15	15 45		0.085	1.350	0.100	0.095	0.230
75/07/07	15 35		0.025	1.300	0.050	0.110	0.170
75/07/18	14 00		0.200	0.825	0.045	0.100	0.130
75/08/13	11 00		0.155	1.400	0.065	0.165	0.340
75/09/17	10 35		0.005	1.400	0.140	0.055	0.230
75/10/21	11 10		0.060	1.500	0.040	0.040	0.150

K VALUE KNOWN TO BE LESS
THAN INDICATED

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1975

STATE OF NEVADA

Mean or median values for six of the key parameters evaluated in establishing the trophic conditions of Nevada lakes sampled are presented to allow direct comparison of the ranking, by parameter, of each lake relative to the others. Median total phosphorus, median inorganic nitrogen and median dissolved orthophosphorus levels are expressed in mg/l. Chlorophyll a values are expressed in µg/l. To maintain consistent rank order with the preceding parameters, the mean Secchi disc depth, in inches, is subtracted from 500. Similarly, minimum dissolved oxygen values are subtracted from 15 to create table entries.

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3201	LAKE MEAD	0.016	0.340	266.565	3.111	11.400	0.005
3202	LAHONTAN RESERVOIR	0.198	0.350	472.083	4.608	10.400	0.148
3204	RYE PATCH RESERVOIR	0.094	0.050	467.750	4.938	10.000	0.039
3205	LAKE TAHOE	0.005	0.040	-3.269	0.571	10.200	0.003
3206	TOPAZ RESERVOIR	0.057	0.165	376.000	7.517	14.600	0.041
3207	UPPER PAHRANGAT LAKE	0.173	0.125	470.000	---	8.600	0.026
3208	WASHOE LAKE	0.403	0.130	494.555	11.633	7.200	0.268
3209	WILD HORSE RESERVOIR	0.114	0.320	489.400	75.530	14.600	0.065
3210	WILSON RESERVOIR	0.049	0.120	197.333	10.033	11.400	0.016
3211	WALKER LAKE	0.602	0.080	405.333	3.422	15.000	0.574

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3201	LAKE MEAD	89 (8)	11 (1)	78 (7)	88 (7)	39 (3)	89 (8)
3202	LAHONTAN RESERVOIR	22 (2)	0 (0)	22 (2)	63 (5)	56 (5)	22 (2)
3204	RYE PATCH RESERVOIR	56 (5)	89 (8)	44 (4)	50 (4)	78 (7)	56 (5)
3205	LAKE TAHOE	100 (9)	100 (9)	100 (9)	100 (8)	67 (6)	100 (9)
3206	TOPAZ RESERVOIR	67 (6)	33 (3)	67 (6)	38 (3)	17 (1)	44 (4)
3207	UPPER PAHRANAGAT LAKE	33 (3)	56 (5)	33 (3)	---	89 (8)	67 (6)
3208	WASHOE LAKE	11 (1)	44 (4)	0 (0)	13 (1)	100 (9)	11 (1)
3209	WILD HORSE RESERVOIR	44 (4)	22 (2)	11 (1)	0 (0)	17 (1)	33 (3)
3210	WILSON RESERVOIR	78 (7)	67 (6)	89 (8)	25 (2)	39 (3)	78 (7)
3211	WALKER LAKE	0 (0)	78 (7)	56 (5)	75 (6)	0 (0)	0 (0)